



CY3270

PSoC® FirstTouch™ Guide

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1. Introduction



The PSoC® FirstTouch™ Kit includes a USB interface dongle, referred to as the FTPC bridge, and a multifunction expansion card, referred to as the FTMF Expansion Card. The FTMF Expansion Card demonstrates a variety of applications using 'PSoC Powered Peripherals'. The FTMF Expansion Card connects to the bridge through the bridge's built-in 8x2 pin expansion port. As the name implies, the FTPC bridge forms the connection between the FTMF Expansion Card and the various PC applications that control and communicate with the FTMF Expansion Card.

The FTPC bridge portion of the kit contains a programmed Cypress CY8C24894 PSoC that performs all of the USB and expansion card interface functions. The firmware that is run by this PSoC performs the primary functions listed.

- Functions as a USB physical and logical interface
- Provides PSoC MiniProg emulation for In System Serial Programming (ISSP) of the expansion cards
- Provides communications with the PSoC programming utility
- Performs HID data channel communications
- Performs expansion card I2C™ communications
- Performs expansion card SPI communications

There are no other active components inside of the FTPC bridge. All of these interfaces run on a single PSoC device. Future projects for the FirstTouch Kit allow you to modify the FTPC firmware and try some USB Interface designs of your own.

The FirstTouch expansion card connects to the FTPC bridge through the bridge's 8x2 pin expansion port. This expansion port provides all of the necessary signals to program the host PSoC on the expansion card. The expansion port also provides power, ground, and I2C or SPI communications to and from the expansion card host PSoC and PC.

Since the FirstTouch expansion card has a dedicated host PSoC, once programmed with your design, the expansion cards can operate either detached from the FTPC bridge in standalone mode or connected to your system hardware. Obviously, it is necessary to provide power and ground for the expansion card to operate in either of these two arrangements.

There are four unused analog or digital GPIO pins on the FTPC port and four unused analog or digital GPIO pins on the expansion card. This allows you to create custom designs and connect signals you want to the FTPC bridge or the FirstTouch expansion cards.

1.1 Document History

This section serves as a chronicle of the *CY3270 PSoC® FirstTouch™ Guide*.

CY3270 PSoC® FirstTouch™ Guide History

Release Date	Firmware Revision	Guide Version	Originator	Description of Change
09/05/07	See Note ^a	**	ARI	This guide is a new document.

^a PSoC Express 3.0 generates the firmware.

1.2 Document Conventions

This guide uses the *Courier New* font to distinguish file location and source code examples from regular text. File names are presented in *italics* text. Keyboard commands are **bolded**.

2. Getting Started



2.1 Install Hardware and Run the CapSense Touch Sensing Design

To install the kit hardware and run the CapSense touch sensing design, do as follows:

1. Remove both end caps from the FTFC Bridge and then connect the FTMF Expansion Card into the header of the FTFC Bridge such that 'Cypress Perform' is visible on both boards. Insert the assembled kit into your computer USB port. Select **Cancel** in the 'Found New Hardware Wizard' window that appears.
2. Slide finger along the CapSense Touch Sensing slider found on the furthest point away from your computer. Notice the LED variation based on the position of your finger on the slider. This is the CapSense Touch Sensing Design working right out of the box.

2.2 Install Software

To install the software, proceed as follows:

1. Remove the PSoC FirstTouch Starter Kit from your computer USB port.
2. Insert the FirstTouch Kit CD-ROM into your computer. The CD is designed to 'Auto Run' and the PSoC Express installation menu should appear. Alternatively, you can double click on the *Auto-run.exe* file in the root directory of the CD-ROM to get the installation menu.
3. From the PSoC Express installation menu, select **Install PSoC Programmer**. When that is complete, select **Install .NET Framework**. When that is complete, select **Install PSoC Express** and then select **Express Pack 1 for PSoC Express** in that order (You can also find the latest software versions at www.cypress.com/FirstTouch). For each installation, follow the instructions issued by the installation wizard. To copy the kit documents to your computer, select **Install First-Touch kit documentation**. This copies the documents to the C:\Cypress\CY3270 directory.
4. Once the software installations are complete, click **Exit** in the PSoC Express Installation Menu.
5. Insert the PSoC FirstTouch Starter Kit (FTFC Bridge and FTMF Expansion Card connected) into your computer USB port. In the 'Found New Hardware Wizard' window, select **No, not this time**. In the second 'Found New Hardware Wizard' window, select **Install the software automatically**. Alternatively, direct the New Hardware wizard to `.\Program Files\Cypress Microsystems\PSoC Programmer\drivers\` on your computer. If prompted with a 'Driver Verification' message, click **Continue Anyway**.

2.3 Run the Temperature, Light, and CapSense Proximity Sensing Designs

To run the temperature, light, and CapSense proximity sensing designs do as follows:

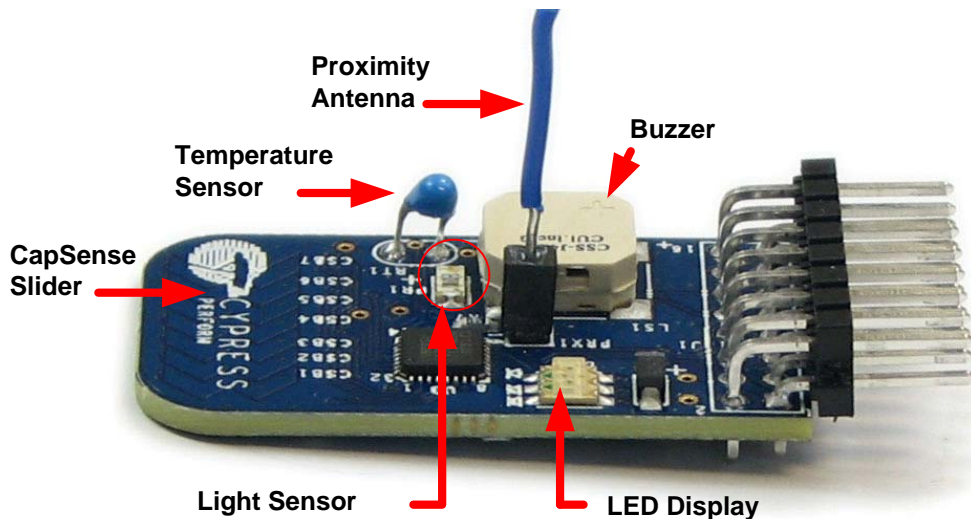
1. Launch PSoC Express.
2. From the Express Design Catalog, expand the 'CY3270-PSoC FirstTouch Kit' folder, and double click on one of the projects and re-name it.

3. From the top menu bar, click **Build** and then select **Generate/Build {your project name} Project**. Click **Next** in the following two screens.
4. From the top menu bar, click **Program** and then select **Programmer**. Within the Programmer window, select **Port > FirstTouch** and set the Programming Mode button to **Reset**. Select the **File Load** button. Within the 'Open' window, double-click **{your project name}.hex** located in `{your project folder}\{your project name}\output` under the default `.\My Documents` folder or the alternate folder you designated. Then, click the **Program** button.
5. Once programming completes successfully, verify the project operation by doing as follows:
 - a. Temperature Sensing—the LED color varies based on changes in the ambient temperature (the buzzer sounds at extreme temperatures).
 - b. Light Sensing—the LED intensity varies based on changes in the ambient light.
 - c. CapSense Proximity Sensing—the LED color varies based on your hand's proximity to the board.

2.4 FTMF Expansion Card Demonstrations

The FTMF Expansion Card provided in your kit is capable of supporting a variety of demonstrations. Each demonstration has an associated PSoC Express project and data sheet that describes the operation and usage of each of the demonstrations in detail. Since the FTMF expansion card has its own PSoC, you can remove it from the FTPC bridge and insert it into your target hardware or other development platform. In order to observe each of the various FTMF demonstrations, it is necessary to reprogram the FTMF card with the appropriate demonstration firmware. For more details refer to the [Technical Reference chapter on page 17](#).

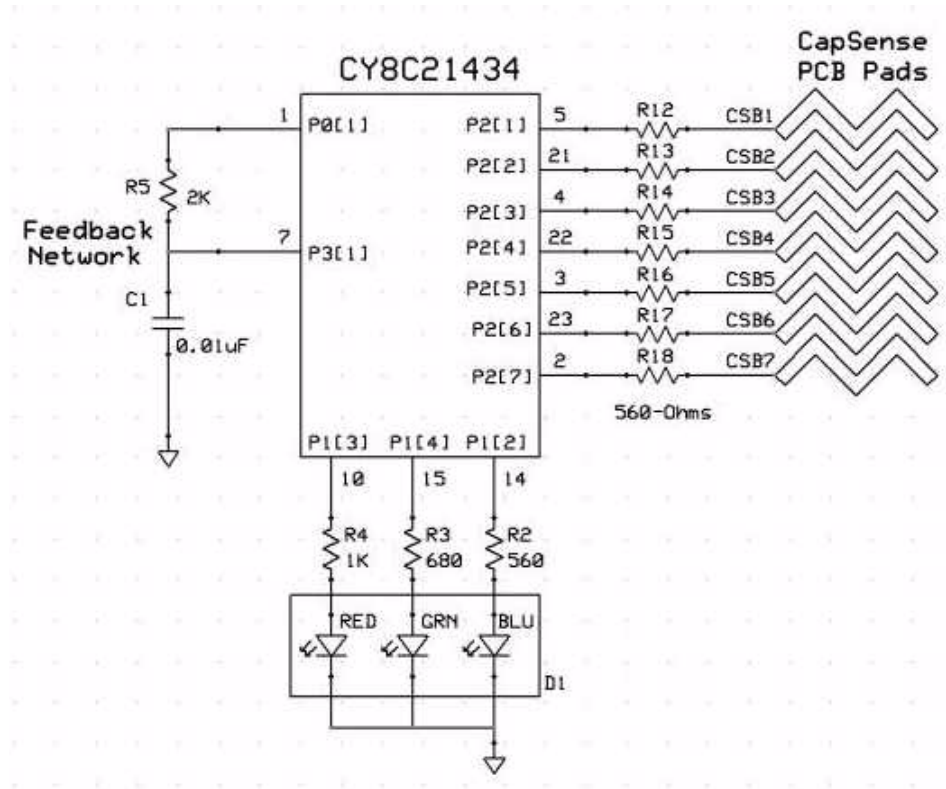
Figure 2-1. FTMF Expansion Card



2.4.1 CapSense Touch Sensing Demonstration (default)

The pre-programmed CapSense Touch Sensing demonstration shows how to use the CapSense Touch Sensing slider to control LED color. Run your finger across the CapSense Touch Sensing slider (see [Figure 2-1](#)) and notice how the color of the LED color changes. The CY8C21434 PSoC that resides on the FTMF Expansion Card detects your finger's position on the CapSense Touch Sensing slider and controls the LEDs output.

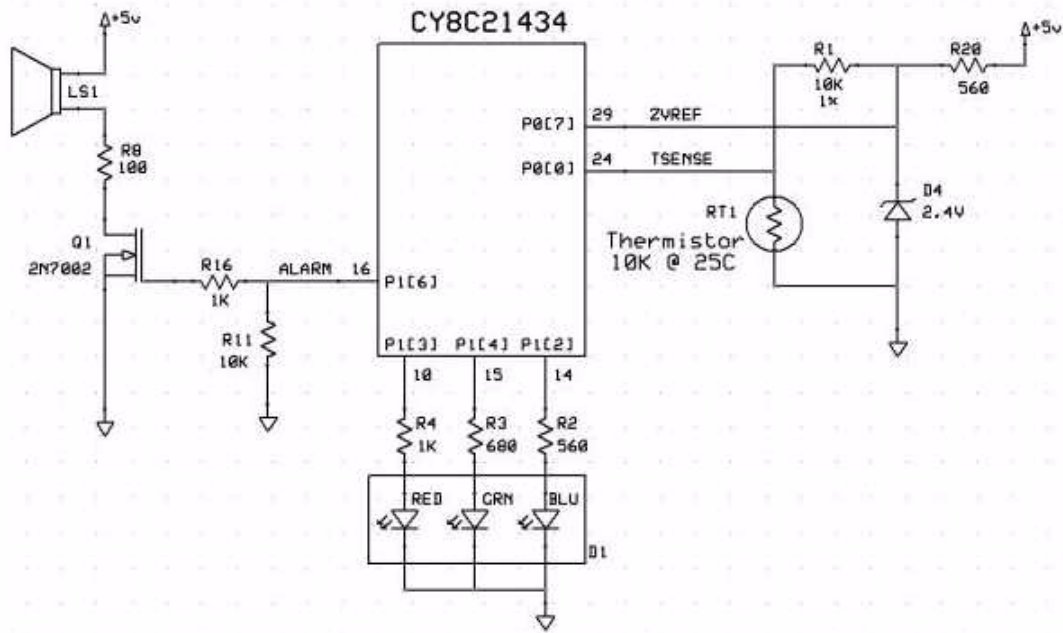
Figure 2-2. CapSense Touch Sensing Demo Schematic



2.4.2 Temperature Sensing Demonstration

The temperature sensing demonstration shows how to use a temperature sensor to control LED color. Follow the CapSense Touch Sensing based guidelines in section [2.5 Exploring the FTMF Expansion Card Demonstration Projects](#) to simulate, build, and program the FTMF Expansion Board with the temperature sensing demonstration. Touch the temperature sensor (see [Figure 2-1](#)) and notice how the LED color changes. Removing your finger leads to the LED color slowly reverting back to its initial state. The CY8C21434 PSoC that resides on the FTMF Expansion Card detects the temperature and controls the LEDs output.

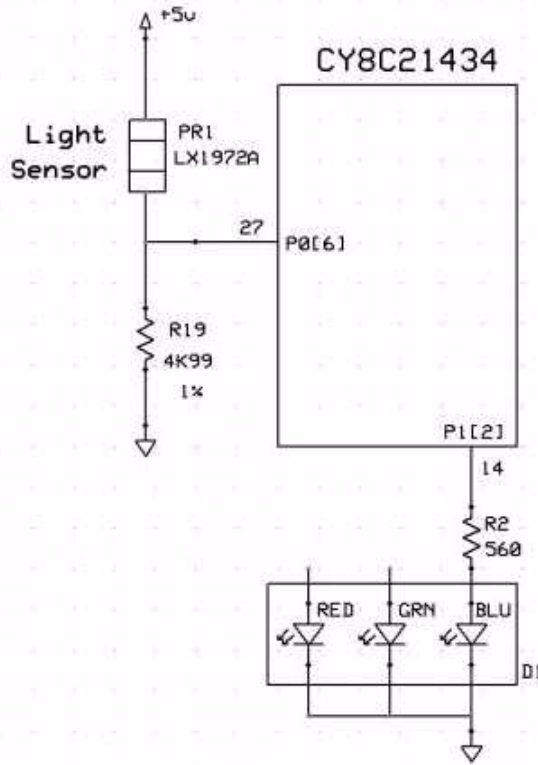
Figure 2-3. Temperature Sensing Demo Schematic



2.4.3 Light Sensing Demonstration

The light sensing demonstration shows how to use an ambient light sensor to control LED intensity. Follow the CapSense Touch Sensing based guidelines in section [2.5 Exploring the FTMF Expansion Card Demonstration Projects](#) to simulate, build, and program the FTMF Expansion Board with the ambient light sensing demonstration. Cover the light sensor (see [Figure 2-1 on page 8](#)) with the palm of your hand and notice how the intensity of the LED changes. Removing your palm leads to the LED intensity reverting back to its initial state. The CY8C21434 PSoC that resides on the FTMF Expansion Card detects the ambient light and controls the LEDs output.

Figure 2-4. Light Sensing Demo Schematic



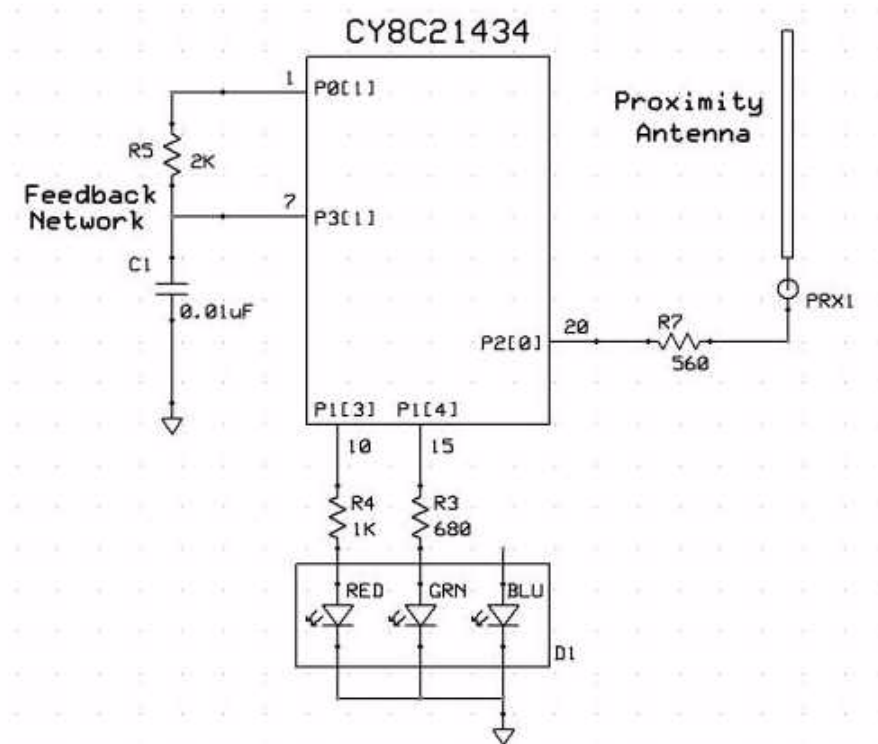
2.4.4 CapSense Proximity Sensing Demonstration

The CapSense proximity sensing demonstration shows how to use a proximity sensor to control LED color.

The proximity detector requires the use of a Proximity Antenna and can sense an object with approximately 2–3 inches of range. In the FirstTouch Kit, this sense antenna is formed by attaching the provided wire into the pin socket labeled PRX1 as shown in [Figure 2-1 on page 8](#). **Note** Upon power up, the FTMF will establish a baseline reading of the Proximity Antenna. It is therefore necessary to connect the Proximity Antenna prior to plugging in the FirstTouch kit.

The project is setup to recalculate this baseline approximately every 30 seconds. Also notice how the shape and position of the wire affects the demonstration operation and the proximity sensing distance.

Figure 2-5. CapSense Proximity Sensing Demo Schematic



Follow the CapSense Touch Sensing based guidelines in section [2.5 Exploring the FTMF Expansion Card Demonstration Projects](#) to simulate, build, and program the FTMF Expansion Board with the CapSense proximity sensing demonstration. Slowly approach the CapSense proximity sensor (depicted in [Figure 2-1 on page 8](#)) with your fingers and notice how the color of the LED color changes. Removing your fingers leads to the LED color slowly reverting back to its initial state. The CY8C21434 PSoC that resides on the FTMF Expansion Card detects the relative proximity of your fingers to the FTMF Expansion Card and controls the LEDs output.

2.5 Exploring the FTMF Expansion Card Demonstration Projects

To explore the various FTMF Expansion Card projects, do as follows:

1. Remove the FTPC Bridge from the USB port on the PC.
2. Connect the FTMF Expansion Card into the header of the FTPC Bridge such that 'Cypress Perform' is visible on both the FTPC Bridge and the FTMF Expansion Card.
3. Once the two are properly connected, insert the complete FirstTouch Kit back into the USB port.

2.5.1 Opening a Demonstration Project

To run demonstration project, do as follows:

1. Launch the PSoC Express Development Suite. Once PSoC Express loads, the Express Design Catalog panel is displayed in the Start Page pane.
2. From the Express Design Catalog, expand the 'CY3270-PSoC FirstTouch Kit' folder.
3. Click the CapSense Touch Sensing Slider entry. A design data sheet appears in the Express Helper panel. This data sheet describes all of the details relating to this particular project.

Since this is a Design Catalog project, you cannot change this project directly. Instead, rename the project and save it to a new location. This makes a copy of the project that you are free to change.

4. Double-click the MultiFunction Board CapSense Touch Sensing Slider entry. A dialog box appears prompting you for a project name and location. Browse to the location where you want to save this project, give it a name, and click **OK**.

PSoC Express 'clones' the contents of the MultiFunction Board CapSense Slider demonstration project and the Project Design window appears.

Note Other documentation included with the PSoC Express Development Suite gives detailed descriptions about the operation of PSoC Express.

2.5.2 Modifying the New Project

One example of modifying the demonstration project is as follows:

1. Place the cursor over the LED icon that appears on the Design window.
2. Right click and select **Transfer Function**.
3. From the Transfer Function window, select the **Edit Transfer Logic** radio button.
4. Click **OK** from the dialog box that appears.

Once the Priority Encoder Transfer Function window appears, notice the details of how the CapSense Slider affects the LEDs.

For this simple demonstration, you can change the order of the LEDs.

1. Left click in the **LED_State_Blue** area and delete the text in the 'then' field.
2. Right click to get menu options, then double-click on **LED_State_Red** from the list.
3. Left click in the original **LED_State_Red** area and delete the test in the 'then' field.
4. Right click to get the options, then double-click on **LED_State_Blue** from the list.
5. Click **OK** to continue.

2.5.3 Simulating the Project

Simulation is a very useful tool. You can run the simulation on the project you defined; if the results are not what you expected, you can go and change the design until you get the results you want. This saves time and effort by allowing evaluation of your design's operation prior to programming the hardware.

Once you have made changes to your project, click the **Simulation** tab to proceed to the PSoC Express Design Simulator to verify that your design does what you intended. For instance, type **23** in the CSD Properties 'Current Value' box and see the 'Red' come up in the LED 'Current Value' box. This matches the transfer function logic designed into this project.

If the behavior meets your expectations, you are ready for the next step. If not, you can go back to the Design tab, edit the Transfer Function logic, and return to Simulation to verify your changes.

Other PSoC evaluation and development kits implement monitoring and tuning to change project variables in real-time and then dynamically change the driver configuration.

2.5.4 Building the New Project

Once you are confident that your design is correct, from the top menu bar click **Build** and then select **Generate/Build {your project name} Project**.

2.5.4.1 *Selecting the Target Device*

PSoC Express displays a Device Selection window that allows you to select a 'target' device for your project. All FTMF Expansion Card projects must use the 32-pin CY8C21434 as the device target. Select this device from the list and click **Next**. Express then continues to compile your project.

2.5.4.2 *Specifying the Target Device Pinout*

The Express Pin Editor window appears. This window allows you to drag and drop the various project signals to the PSoC device IO pins. For this project, no changes are made to the pin assignments. Click **Next** to continue.

Note If you are creating your own project for the FTMF card, refer to the [Figure 3-4 on page 21](#) for a schematic and [Table 3-1 on page 22](#) for the pin connections before proceeding beyond this point.

Once PSoC Express completes building your design, the BOM/Schematic window appears. Use this as an error-checking step to confirm that all of the IO pins did not move and are exactly where you intended.

2.5.5 Programming the Project

To program the project to the FTMF Expansion Card, do as follows:

1. From the top menu bar, click **Program** and then select **PSoC Programmer**. The PSoC Programmer utility launches.
2. On the Programmer GUI, select **Port > FirstTouch**.
3. Ensure that the Device Family is set to 21X34 and the Device Type is CY8C21434-24LFXI (this is the PSoC on the FTMF Expansion Card).
4. Set the Programming Mode button to **Reset** and then click the **Program** button.

The Programmer utility begins programming the project's HEX file to the FTFC bridge; the bridge in turn re-programs the PSoC on the FTMF Expansion Card.

2.5.6 Verifying the Results

Once the programming completes successfully, the FTPC Bridge resets the FTMF Expansion Card and begins running your project on the FTMF Expansion Card. Verify the project as follows:

Did the changes that were made take effect?

If not, return to the PSoC Express Design Editor, make any necessary changes, and reprogram your FTMF Expansion Card again.

2.5.7 Understanding the Results

The steps described throughout the section [Exploring the FTMF Expansion Card Demonstration Projects on page 13](#) demonstrate the entire flow of PSoC Express, PSoC Programmer, and the First-Touch Kit. You now know the process and PSoC Express Design Flow to make your own projects or to load another FTMF Expansion Card demonstration project from the Express Design Catalog.

2.5.8 Important Things to Remember

There are a few important points to remember when working with the FirstTouch kit and projects.

1. Use the FTMF Expansion Card schematic, pin assignment tables, or both when creating a project. Failure to do so almost certainly guarantees that your project will not behave as planned.
2. Select the proper device to use as the 'host' on the particular expansion card with which you are working.
3. Always use the 'Reset' programming mode when programming through the FTFC bridge.

3. Technical Reference



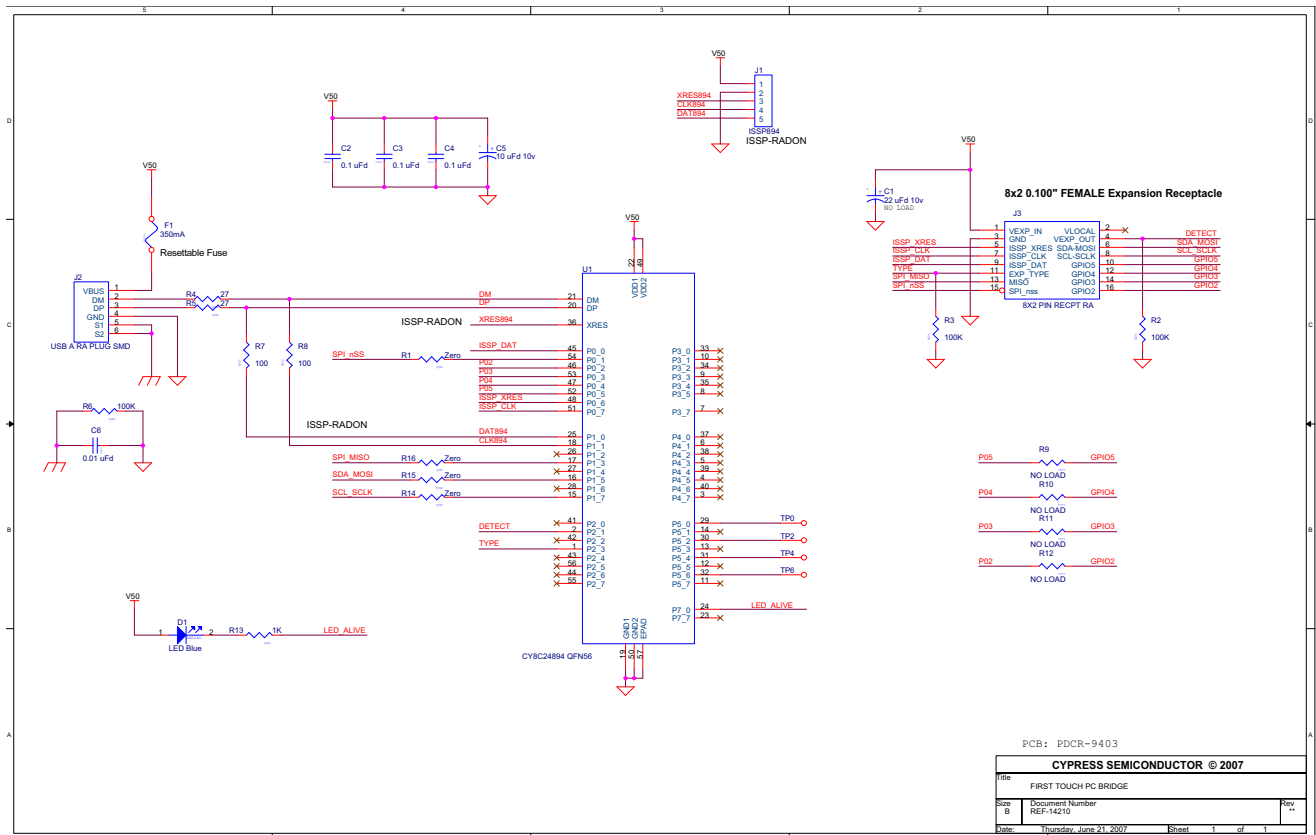
3.1 FTPC Bridge Details

The FTPC Bridge is the interface bridge between the expansion cards, your PC, and the various applications such as PSoC Express™, PSoC Designer™, and the PSoC Programmer utility.

Since the FTPC Bridge enumerates as a special type of 'combo device' that contains a PSoC Mini-Prog interface, the standard PSoC Programmer utility can identify and communicate with the FTPC bridge. This ensures that your FirstTouch Kit is automatically compatible with both PSoC Express and PSoC Designer.

The schematic for the FTPC Bridge shown in Figure 3-1 is found on the CD included in the kit.

Figure 3-1. FTPC Bridge Schematic

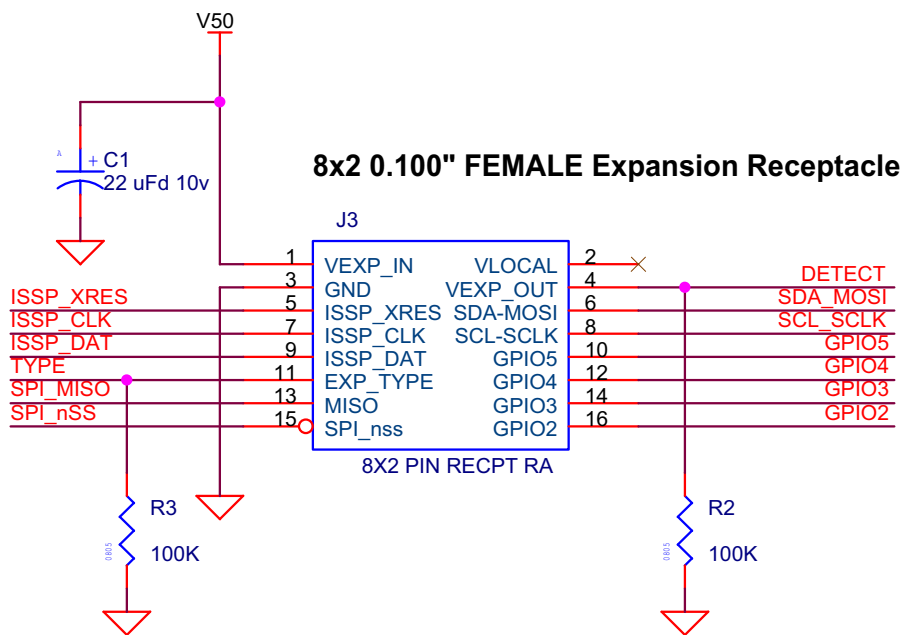


Noticed that the CY8C24894 PSoC device is the only active component in the entire circuit. This single PSoC handles all communications between the applications, USB, and expansion card interfaces.

The FirstTouch expansion card connects to the FTPC bridge through the 8x2 Expansion Port (this is a built-in port on the bridge). If you are using only the FirstTouch expansion card, it is generally not necessary to understand everything about this expansion port or the signals that it contains. By attaching an expansion card, all of the necessary connections are made.

Figure 3-2 is the pinout diagram for the FTPC Expansion Port. Refer to this figure as you create projects. As you get more accustomed to the FirstTouch Kit and design flow, you may find yourself wanting to make your own expansion cards. At that time, you may want to review the interface signals.

Figure 3-2. FTPC Expansion Port Pinout Diagram



3.2 Expansion Card Overview

The FirstTouch expansion card is designed to plug and play with the FTFC bridge. All power for the included expansion cards is provided by the FTFC bridge directly from the USB bus. No other power supply is necessary when an expansion card is connected to the FTFC bridge. Connection to the FTFC Expansion Port is through the 8x2 or 5x2 pin header on the expansion card.

The FirstTouch expansion cards have a dedicated host PSoC device installed. The particular PSoC installed was chosen to act as an example as to which PSoC is most suitable for the types of applications that the particular expansion card supports. This also makes it easier to transfer your design from the FirstTouch kit to your hardware.

By having a dedicated host PSoC, you can program then remove the expansion card from the FTFC bridge. Once removed, it operates in a standalone mode or connects to your system level hardware. This creates a design that provides 'PSoC Powered Peripherals' and quickly integrate them into your system. Before doing so, it is important to review the schematic for the particular expansion card, to determine the proper power and ground connections and voltage levels.

The expansion card contain a variety of peripheral components that allow you to experiment with many different sensors and signal types. Each of the sensors use dedicated host PSoC IO pins. Therefore, it is important to note which pins connect the various sensors to the host PSoC. These details are provided in the expansion card specific portion of this guide.

3.3 Expansion Card Details

This section provides details for the expansion cards included with the FirstTouch Kit. Future expansion cards will include additional documentation and demonstration projects that are specific to their operation and configuration.

3.3.1 FirstTouch MultiFunction Expansion (FTMF) Card

The FTMF Expansion Card contains a CY8C21434 PSoC that acts as the 'host' for various demonstrations. The FTMF Expansion Card has hardware to support the following PSoC powered peripheral applications:

- CapSense 'Touch Button'
- CapSense '7-Element Touch Slider'
- CapSense 'Non-Touch / Proximity Detection'
- Ambient light-level detection
- Thermistor-based temperature measurement

In addition to the above input sensors, the FTMF card also provides the following output devices:

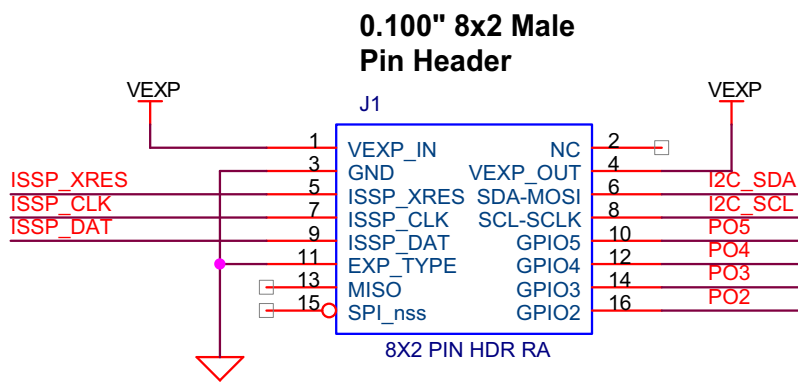
- Red-Green-Blue triple LED cluster
- Audible magnet transducer or speaker, or both
- I2C digital communications
- Four unused A/D GPIO lines for user functions

The dedicated sensors and output devices on the FTMF Expansion Card are there to help you quickly evaluate and experiment with a variety of PSoC applications, without having to build any hardware. Your PSoC Express or PSoC Designer project completely determines the remaining FTMF Expansion Card functions. Included in the kit installation are demonstration projects that use the following input sensors:

- CapSense slider
- Temperature sensor
- Ambient Light sensor
- CapSense proximity sensor

The FTMF Expansion Card uses a standard FirstTouch expansion header for connection to the FTPC bridge or other target hardware.

Figure 3-3. FTMF Expansion Card Expansion Header Signals

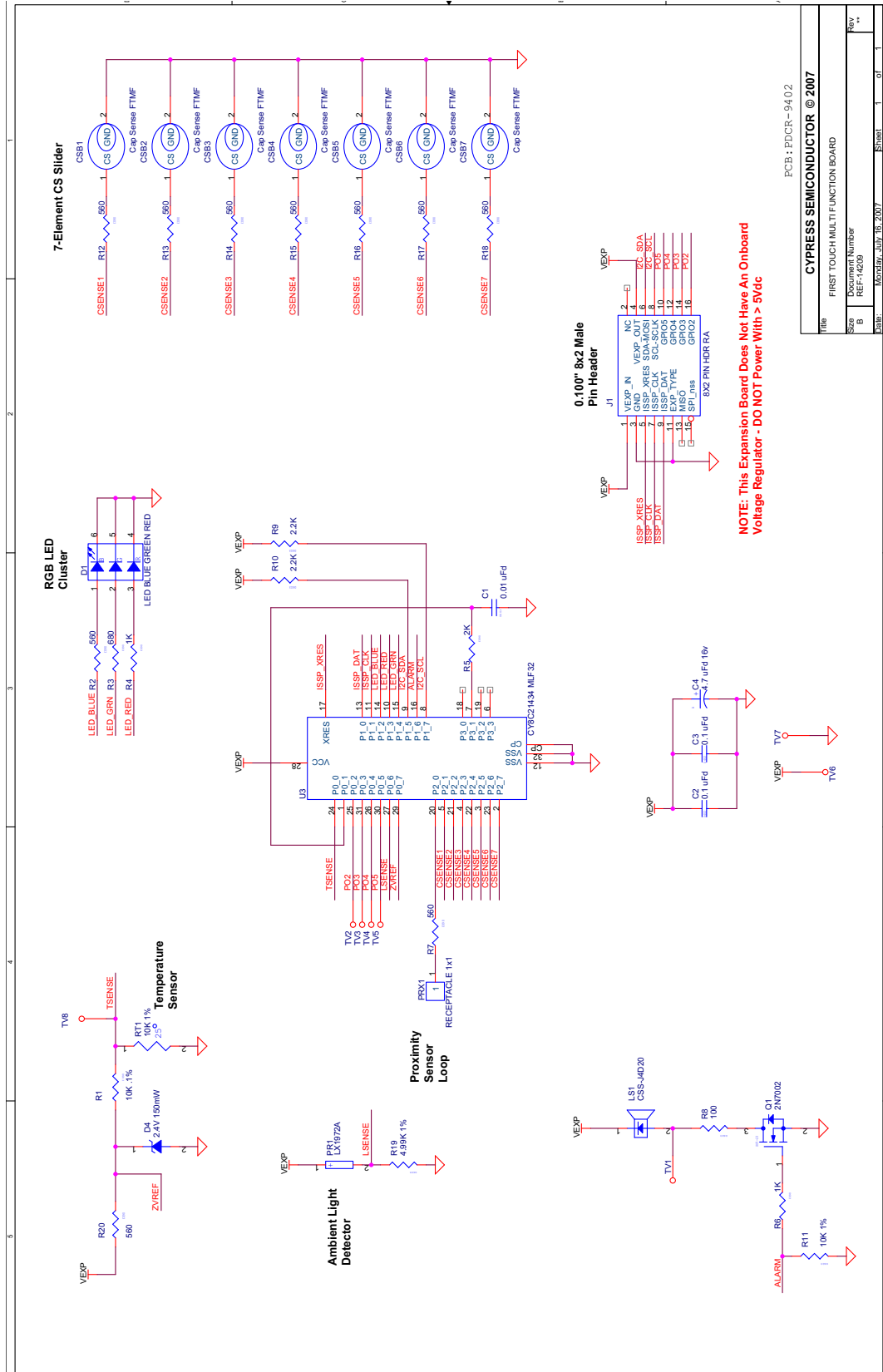


**NOTE: This Expansion Board Does Not Have An Onboard
Voltage Regulator - DO NOT Power With > 5Vdc**

Notice that the 8x2 pin expansion header also includes four General Purpose IO connections labeled P02-P05. These are hard wired to four unused Port 0 IO pins on the CY8C21434 host and allow you to easily connect the FTMF Expansion Card to your specific hardware or sensors. These IO pins were specifically chosen because they have the ability to operate as analog outputs, analog inputs, digital inputs, digital outputs, or any combination of the four types; this pin selection makes them true analog or digital GPIO.

Your PSoC Express project designates the specific function for these A/D GPIO pins.

Figure 3-4. FTMF Expansion Card Schematic



NOTE: This Expansion Board Does Not Have An Onboard Voltage Regulator - DO NOT Power With > 5Vdc

Doc ID	001-15945
Doc Name	FirstTouch™ Multi-Function Board
Doc Rev	1.0
Doc Date	2007-07-16
Doc Author	...
Doc Engineer	...
Doc Designer	...
Doc Checker	...
Doc Approver	...
Doc Status	...

Since the FTMF Expansion Card connects the various sensors and output devices to predefined IO of the host CY8C21434, it is important that you follow the pin assignment shown in [Figure 3-4 on page 21](#) and [Table 3-1](#).

The schematic for the FTMF Expansion Card shown in [Figure 3-4](#) is found on the CD included in the kit.

Table 3-1. FTMF PSoC Pin Assignments

Pin Number	Port Number	Design Function
1	P0[1]	CapSense modulator capacitor
2	P2[7]	CapSense slider element 7
3	P2[5]	CapSense slider element 5
4	P2[3]	CapSense slider element 3
5	P2[1]	CapSense slider element 1
6	P3[3]	Unused / no-connect
7	P3[1]	CapSense feedback resistor
8	P1[7]	I2C clock line (SCL)
9	P1[5]	I2C data line (SDA)
10	P1[3]	Red LED drive
11	P1[1]	In system programming clock (ISSP_SCLK)
12	GND	
13	P1[0]	In system programming data (ISSP_DAT)
14	P1[2]	Blue LED drive
15	P1[4]	Green LED drive
16	P1[6]	Alarm/buzzer FET drive
17	XRES	In system programming reset pin (ISSP_XRES)
18	P3[0]	Unused / no-connect
19	P3[2]	Unused / no-connect
20	P2[0]	CapSense proximity antenna pad (PRX1)
21	P2[2]	CapSense slider element 2
22	P2[4]	CapSense slider element 4
23	P2[6]	CapSense slider element 6
24	P0[0]	Thermistor temperature sensor analog input
25	P0[2]	User A/D-GPIO
26	P0[4]	User A/D-GPIO
27	P0[6]	Ambient light detector analog input
28	+Vdd	
29	P0[7]	Thermistor drive-voltage reference analog input
30	P0[5]	User A/D-GPIO
31	P0[3]	User A/D-GPIO
32	GND	

You can use the sensors and output devices in any way you want within your project, but you must make sure to always assign the correct pins within your project. Failure to do so may cause unpredictable or unplanned project results.

Referring to [Figure 3-4 on page 21](#), for instance, notice that a capacitor and a resistor connect to Port P0[1] and P3[1]. These two components form the feedback network required for all CapSense. When you assign the pinout in your PSoC Express CapSense projects, make certain to assign these pins to the correct functions.

